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Anhydrous Ammonia Fertilizer

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SD FS 557

ND S-F 14

anhydrous ammonia fertilizer



**Cooperative Extension Service
U. S. Department of Agriculture
South Dakota State University, Brookings
North Dakota State University, Fargo**

anhydrous ammonia fertilizer

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Introduction

Agricultural use of anhydrous ammonia has increased significantly throughout the United States. It is one of the most economical fertilizer sources of nitrogen. Research shows it to be essentially equal to other forms of nitrogen fertilizer, pound for pound of actual nitrogen applied, in promoting plant growth.

Application

Time

Anhydrous ammonia can be effectively applied at different times during the year. It can be applied in the fall, in spring as preplant and as a sidedress, or as post-plant application. Toxic effects of anhydrous ammonia can cause delayed emergence or reductions in stands if seeds are placed too near the application zone right after the fertilizer is applied. Delaying planting at least 10 days after application will greatly reduce such injury.

Applying the ammonia diagonally with respect to row direction can also reduce injury. It can be applied after crops are seeded and growing, such as a sidedress application on row crops, or an injection into growing small grain. Sidedress applications on row crops should be made as soon as seedling rows can be seen, and before plants are 10 to 12 inches high. Delaying sidedressing until such crops are 15 to 20 inches tall frequently means the crop will not get maximum benefits from that fertilizer investment. Root pruning is also thought to restrict or adversely affect yields where sidedress applications are made too late in the growing season. Similarly, post-plant injections on small grain should be applied early in spring for best results.

Farmers are frequently discouraged from making fall applications of anhydrous ammonia until surface soil temperatures reach 50 degrees F. or below. Warmer soil temperature hastens the rate at which this fertilizer material is converted into a form more easily leached. However, fall and overwinter leaching losses in North and South Dakota are thought to be insignificant because of limited rainfall and the frozen condition of the soil. For these reasons SDSU and NDSU plant scientists suggest that applications of anhydrous ammonia can be made any time in the fall, regardless of soil temperature, on most medium and fine textured soils.

Method

Anhydrous ammonia can be applied prior to or after planting as a separate treatment, or in combination with tillage operations. An increasing number of farmers have equipped moldboard plows, chisel plows,

sweep-type implements, and other tillage equipment with anhydrous ammonia attachments that combine tillage and fertilizer application into one field operation. Vapor loss can occur during and after application if soil does not seal off and trap the gaseous fertilizer in soil. Soils can be both too dry and cloddy as well as too wet. In either instance, poor sealing behind the injection knife permits vapors to escape. While soil moisture levels can be too high for good plowing, in general those considered ideal for plowing are also best for applying anhydrous ammonia.

Depth

Important losses of anhydrous ammonia can occur if depth of application is too shallow. This fertilizer should be placed 7 to 9 inches deep on most soils. Increased nitrogen loss can occur where more shallow placement is made. This is particularly true on very sandy soils or where nitrogen rates of perhaps 100 to 150 pounds per acre are applied on 38- to 40-inch interval spacing. Application depth can be slightly reduced where interval spacing is closer or where lower application rates are used.

In some instances, operators inject anhydrous ammonia first and then plow the field. Gaseous nitrogen loss has been reported where the ammonia-saturated soil is tilled or plowed and exposed to the air too soon after application. For this reason, operators are encouraged to delay tillage following application at least 10 days to minimize such loss. Conversion of ammonia in soil into forms not subject to gaseous loss has been shown to be virtually complete in 4 to 8 weeks. In that way, time can minimize loss.

Farmers may also reduce loss by using narrow injection intervals and reduce injection depth to half the normal plowing depth. This would hopefully keep the main fertilizer concentrations still 3 to 4 inches deep after plowing instead of on or near the soil surface. It is felt nitrogen losses from such shallow injections would be less than if the material was injected deep and then exposed to the atmosphere.

Rates

Application rates should be based on soil tests and yield potentials. Recommended rates will vary widely depending on soil type, management, and crops to be grown. Recommended nitrogen rates based on soil tests can be found in various South Dakota factsheets and North Dakota circulars. A listing of these publications is printed on the back page of this factsheet.



Anhydrous ammonia requires special storage and handling equipment, yet it is one of the most economical forms of nitrogen fertilizer.



Trailing the dealer supply tank behind applicator saves time and costs compared to transferring the fertilizer from the supply tank to applicator tank.

Properties

Table 1 lists some of the properties of anhydrous ammonia. For example, it is colorless in gaseous form; the cloud you see when it is released to the air is actually a condensed water vapor cloud resulting from the cooling effect of the liquid changing to a gas. The gas is compressed into liquid form for easier storage and transfer. The material boils at -28 degrees (F.) under atmospheric conditions, meaning it changes from a liquid to a gas as material temperatures rise above -28 degrees. It can be seen from Table 2 that potentially very high pressures can develop inside tanks as fertilizer temperature increases. For this reason special storage and application equipment are required. This reemphasizes the need for using safe operating procedures and equipment; however, this is also true for every agricultural chemical.

The liquid is caustic and capable of burning both internal and external body tissue. Immediate thorough washing for 15-20 minutes can greatly reduce or even prevent personal injury. The strongly pungent odor of the vapor is so unpleasant that operators cannot volun-

tarily remain in areas of even moderate concentrations, let alone those levels where injury from suffocation could occur.

SAFETY

Accidental exposure to high concentrations of anhydrous ammonia can be injurious. However, injury can be minimized or even prevented if certain safety precautions are followed. Keep in mind that high concentrations can be caustic to skin if not washed off or diluted with large volumes of water right away. In fact, only a 2% concentration of ammonia gas is generally the maximum tolerated by the skin for more than a few seconds. Freezing action, upon direct contact with the evaporating liquid, can also cause skin burn. However, use of proper clothing, gear, and transfer technique can practically eliminate accidental exposure. The following safety guidelines are recommended:

- Travel crosswind to source, operate upwind if possible.
- Have large volumes of water readily available.

Hose lines 3 to 4 feet long delay release of the gaseous fertilizer under furrow slice.



Anhydrous ammonia can be injected in small grain stubble to meet nutrient needs of next crop.





Various tillage tools such as this narrow sweep equipment can be adapted to apply anhydrous ammonia.



Anhydrous ammonia application and plowing can be combined into one operation.

- Thoroughly wash exposed victims with water (15-20 minutes).
- Do not apply burn salve to exposed tissue.
- Evacuate downwind residents.
- Avoid flushing water-ammonia mixture into sewer.
- Don't spray water on puddles of liquid ammonia.
- Use water shield (hose) to gain access to victims, valves, etc.
- Check replacement needs of equipment before heavy use period.
- Use goggles and rubber gear (gloves, etc.) when transferring material.

Table 1. Characteristics of anhydrous ammonia

Weight per gallon (@ 60° F.) 5.15 lbs.

The liquid expands 846 times its original volume as it changes to a gas.

Caustic to external and internal body tissue.

Dissolves readily in water (including perspiration).

Gas vapor is colorless.

Odor—strongly pungent.

Flammable when concentration is 16% to 25%.

Ignition temperature 1,200 degrees F.

Skin burn with liquid changing to vapor.

Vapor slightly lighter than air.

Suffocation may occur if exposed to gas concentrations over 5,000 parts per million for few minutes.

Boils (changes to gas) at -28 degrees F. in atmosphere.

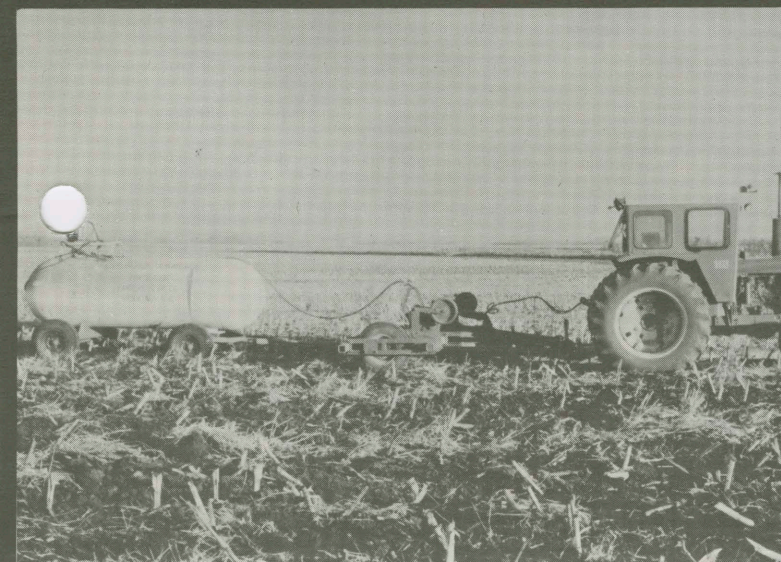
Table 2. Vapor pressure of anhydrous ammonia varies with temperature.

NH ₃ Temperature Degrees/Fahrenheit	Pressure PSI
-28	0
0	15.7
32	47.6
60	92.9
100	197.2
125	293.1
130	315.6

Use of a tradename does not imply endorsement of one brand over another.

COVER PHOTO—Courtesy Farmers Union Central Exchange.

Anhydrous ammonia application and chisel plow tillage can be combined into one operation.



Three point mounted anhydrous ammonia sidedress applicators can be used to make preplant application.



South Dakota factsheets:

FS 425, Fertilizing Pasture and Hayland

FS 432, Fertilizing Corn and Sorghum in South Dakota

FS 435, Fertilizing Small Grain

North Dakota circulars:

S-F 1, Refining Fertilizer Recommendations by State Areas, Stored Soil Moisture Conditions and Rainfall Probabilities

S-F 2, Fertilizing Small Grains (Wheat, Durum, Feed Barley, Oats, Rye)

S-F 3, Fertilizing Sunflowers

S-F 4, Fertilizing Sugarbeets

S-F 5, Fertilizing Potatoes

S-F 6, Fertilizing Canary Seed, Grain Sorghum and Millet

S-F 7, Fertilizing Flax, Mustard and Rape

S-F 8, Fertilizing Alfalfa

S-F 9, Fertilizing Soybeans

S-F 10, Fertilizing Edible Beans (Pinto, Navy)

S-F 11, Fertilizing Native and Tame Grasses

S-F 12, Fertilizing Corn Grain and Silage

S-F 13, Fertilizing Malting Barley

S-F 549, Which Nitrogen Source for Me?

S-F 573, Soil and Water Characteristics Important in Irrigation

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